NOTICE: NEW YORK MEETING POSTPONED

The Journal of Parasitology

Volume 28 December Supplement, 1942

PROGRAM AND ABSTRACTS OF THE EIGHTEENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

NEW YORK, NEW YORK

DECEMBER 28, 29, and 30, 1942

PROGRAM[1]

MONDAY AFTERNOON SESSION, DECEMBER 28, 2:00 P.M.; ROOM 919, HUNTER COLLEGE, 695 PARK AVENUE.

Read

1. Development of the Metacercariae of *Diplostomum flexicaudum* in the Lenses of Frogs, Turtles, Birds, and Mammals. (15 min) (Lantern) M. S. FERGUSON, Rockefeller Institute for Medical Research.

2. The Occurrence of *Cercaria clausii* Monticelli, a Marine Rattenkönig Cercaria, on the West Coast of Florida. (12 min) (Lantern) (Also by demonstration) RAYMOND M. CABLE, Purdue University, and RICHARD A. MCLEAN, Academy of Natural Sciences of Philadelphia.

3. The Life Cycle of *Zoogonoides laevis* Linton, 1940. (10 min) (Lantern) HORACE W. STUNKARD, New York University.

4. The Dorso-Ventral Axis in *Taenia pisiformis*. (10 min) (Lantern) JUSTUS F. MUELLER, New York State College of Forestry.

5. *Stempellia moniezi* n. sp., a Microsporidian (Protozoa; Sporozoa) Parasite of Cestodes. (10 min) (Lantern) ARTHUR W. JONES, University of Virginia.

6. Intestinal Parasitic Infections in a State Mental Hospital, and Control with Aluminum Hydroxide and Colloidal Kaolin. (10 min) HERMAN A. SHELANSKI, W. L. PIOUS AND JESS H. FRANK, University of Pennsylvana and the Philadelphia State Hospital.

7. Anaerobiosis and Cholesterol as Growth Requirements of *Endamoeba histolytica*. (15 min) (Lantern) THOMAS L. SNYDER AND HENRY E. MELENEY, New York University.

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[1] An alphabetical author index will be found at the end of this program, following which is the program (without abstracts) of a Symposium on Tropical Diseases.

Extra copies of this Supplement, and portraits of parasitologists, will be on sale at the meeting.

8. Studies on Reducing Substances and Gas Formation in Cultures of *Endamoeba histolytica* and a Single Species of Symbiotic Bacteria. (10 min) (Lantern) THEODOR VON BRAND, CHARLES W. REES, LEON JACOBS AND LUCY V. REARDON, National Institute of Health.

9. Morphological Characters of the Trichomonad Flagellates of Man. (15 min) (Lantern) DAVID H. WENRICH, University of Pennsylvania.

10. *Trichomonas vaginalis* in Tissue Cultures. (15 min) (Motion picture) M. J. HOGUE, University of Pennsylvania.

11. Report on the JOURNAL OF PARASITOLOGY. (15 min) NORMAN R. STOLL, *Chairman, Editorial Committee.*

By Title

12. The Life Cycles of Three Dermatitis-Producing Cercariae (Trematoda: Schistosomatidae). DONALD B. MCMULLEN, Michigan Stream Control Commission and University of Oklahoma, AND PAUL C. BEAVER, Michigan Stream Control Commission.

13. Methods of Investigation on the Life Cycles of Avian Schistosomes. PAUL C. BEAVER, Michigan Stream Control Commission and Georgia Department of Public Health, AND DONALD B. MCMULLEN, Michigan Stream Control Commission and University of Oklahoma.

14. Studies on Cercariae of the Common Mud-flat Snail, *Cerithidea californica*. II. General Infection Data. WANDA SANBORN HUNTER, University of California at Los Angeles.

15. Taxonomic Value of the Tooth Formula of *Xironodrilus* (Branchiobdellidae). CLARENCE J. GOODNIGHT, University of Illinois.

16. Hydrogen-Ion Concentration of Amoebic Ulcers. GORDON H. BALL, University of California at Los Angeles.

17. Intravaginal Survival of Culture *Trichomonas tenax* (*buccalis*) in Man. ROBERT M. STABLER, University of Pennsylvania, AND L. G. FEO, Jefferson Medical College Hospital.

18. Inoculations of *Trichomonas foetus* (Protozoa) in Guinea Pigs. BANNER BILL MORGAN, University of Wisconsin.

TUESDAY MORNING SESSION, DECEMBER 29, 9:30 A.M.; ROOM 919, HUNTER COLLEGE, 695 PARK AVENUE.

Read

19. Exoerythrocytic Schizogony in a New Species of Saurian *Plasmodium*. (12 min) (Lantern) PAUL E. THOMPSON AND CLAY G. HUFF, University of Chicago.

20. The Effects of Thio-Bismol upon Three Species of Therapeutic Malaria. (10 min) (Lantern) MARTIN D. YOUNG, United States

Public Health Service, SOL B. MCLENDON, AND ROY G. SMARR, South Carolina State Hospital.

21. The Mechanism of Quinine Action in Malaria. (15 min) (Lantern) EMANUEL WALETZKY AND HAROLD W. BROWN, University of North Carolina.

22. The Influence of Biotin upon Susceptibility to Malaria. (15 min) (Lantern) WILLIAM TRAGER, Rockefeller Institute for Medical Research.

23. The Coccidial Nature of "Avian *Toxoplasma*." (15 min) FREDERICK COULSTON, University of Chicago.

24. Maintenance of Human *Toxoplasma* in Chicken Embryos. (10 min) (Lantern) FRUMA WOLFSON, Johns Hopkins University.

25. Minimum Heat Treatment Required for the Destruction of Trichinae in Pork Scraps in Garbage. (10 min) (Lantern) WILLARD H. WRIGHT AND JOHN BOZICEVICH, National Institute of Health.

TUESDAY MORNING, DECEMBER 29, 11:00 A.M.; ROOM 919, HUNTER COLLEGE, 695 PARK AVENUE.

Presidential Address

26. The Rôle of Parasitologists in World War II. HENRY E. MELENEY, New York University College of Medicine.

TUESDAY, DECEMBER 29.

12:30 P.M. PARASITOLOGISTS' LUNCHEON, HUNTER COLLEGE.

1:30 P.M. ANNUAL BUSINESS MEETING.

TUESDAY AFTERNOON SESSION, DECEMBER 29, 3:00 P.M.; ROOM 801, HUNTER COLLEGE, 695 PARK AVENUE. (Tea will be served.)

By Demonstration

2. The Occurrence of *Cercaria clausii* Monticelli, a Marine Rattenkönig Cercaria, on the West Coast of Florida. (Also read) RAYMOND M. CABLE, Purdue University, AND RICHARD A. MCLEAN, Academy of Natural Sciences of Philadelphia.

27. The Effect of Long Ultraviolet and Near Visible Radiation on the Eggs of the Nematodes, *Enterobius vermicularis* and *Ascaris lumbricoides*. MYRNA F. JONES AND ALEXANDER HOLLAENDER, National Institute of Health.

28. *Phyllodistomum etheostomae* n. sp. (Trematoda: Gorgoderidae) from Percid Fishes. JACOB H. FISCHTHAL, University of Michigan.

36. Some Preliminary Experiments on a Skin Test for Immunity to the Stomach Worm, *Haemonchus contortus*, in the Calf. (Also read) ROY L. MAYHEW, Louisiana State University.

65. African Sleeping Sickness. (30 min) (Lantern; motion picture) EUGENE R. KELLERSBERGER, American Mission to Lepers, New York (4:00 P.M., Room 919, Hunter College) (By invitation).

WEDNESDAY MORNING SESSION, DECEMBER 30, 9:30 A.M.; ROOM 919, HUNTER COLLEGE, 695 PARK AVENUE.

Read

29. Increased Mortality in Rats with Concomitant Dual Infections. (10 min) GRAEME A. CANNING AND J. M. FISHER, University of Tennessee.

30. The Effect of Dry-Heating the Ration on Oöcyst Production in *Eimeria nieschulzi* Infections. (12 min) (Lantern) ELERY R. BECKER, Iowa State College.

31. Effect of X-Irradiation upon the Resistance of Rats to *Trypanosoma lewisi.* (10 min) (Lantern) DOROTHY N. NAIMAN, Hunter College, and Columbia University.

32. Number of Larvae and Time Required to Produce Active Immunity in Rats against *Trichinella spiralis.* (10 min) (Lantern) JACOB H. FISCHTHAL, State University of Iowa.

33. *Trichinella* Skin Tests in Apparently Normal Individuals. (10 min) (Lantern) HARRY M. ROSE AND JAMES T. CULBERTSON, Columbia University.

34. Immunological Studies on a Polysaccharide and Protein Fraction Isolated from *Trichinella spiralis.* (15 min) (Lantern) LEO R. MELCHER, University of Chicago. (Introduced by CLAY G. HUFF.)

35. Active Immunization of Sheep against Large Single Test Infections of *Haemonchus contortus.* (15 min) (Lantern) NORMAN R. STOLL, Rockefeller Institute for Medical Research.

36. Some Preliminary Experiments on a Skin Test for Immunity to the Stomach Worm, *Haemonchus contortus,* in the Calf. (15 min) (Lantern) (Also by demonstration) ROY L. MAYHEW, Louisiana State University.

37. Acquired Resistance to the Gapeworm, *Syngamus trachea,* in the Turkey and Ring-Necked Pheasant. (12 min) (Lantern) LOUIS OLIVIER, United States Bureau of Animal Industry.

38. Skin Tests in Schistosomiasis Mansoni Patients with Antigen from *Pneumoneces medioplexus.* (5 min) (Lantern) JAMES T. CULBERTSON AND HARRY M. ROSE, Columbia University.

39. Resistance to *Ascaris lumbricoides* L. in Guinea Pigs and the Eosinophilia Associated with Infection. (15 min) (Lantern) A. MURRAY FALLIS, Ontario Research Foundation.

By Title

40. The Relation of Splenectomy and the Resistance of Old Mice to the Mouse Cestode, *Hymenolepis nana* var. *fraterna*. JOHN E. LARSH, JR., Johns Hopkins University.

41. The Effect of *Ascaris suum* Extract Injections upon Chickens Infected with *Ascaridia lineata*. L. L. EISENBRANDT, University of Kansas City.

42. Effects of the Nematode, *Trichostrongylus colubriformis*, on the Nutrition of Lambs. JOHN S. ANDREWS, W. R. KAUFFMAN, AND R. E. DAVIS, United States Bureau of Animal Industry.

43. Symptoms and Immunity Following Graduated Doses of *Eimeria tenella*. HARRY A. JANKIEWICZ, University of Southern California.

44. Studies on Susceptibility of Chickens to Cecal Coccidiosis. C. A. HERRICK AND S. A. EDGAR, University of Wisconsin.

WEDNESDAY AFTERNOON SESSION, DECEMBER 30, 2:00 P.M.; ROOM 919, HUNTER COLLEGE, 695 PARK AVENUE.

Read

45. The Magnitude of the Hookworm Problem in a Typical County of Southern Georgia. (12 min) (Lantern) J. ALLEN SCOTT AND JUSTIN ANDREWS, Georgia Department of Public Health.

46. Use of Calcium Chloride to Isolate Helminth Ova from Soil. (10 min) ROBERT T. STEVENSON, University of Wisconsin. (Introduced by C. A. HERRICK.)

47. Phenothiazine in the Treatment of Enterobiasis. (10 min) ELLA KUITUNEN, University of Toronto. (Introduced by A. MURRAY FALLIS.)

48. The Efficacy of Phenothiazine and Nicotine-Bentonite for the Removal of *Heterakis gallinae* and *Ascaridia galli* from Chickens. (15 min) (Lantern) JAMES E. GUTHRIE AND PAUL D. HARWOOD, Dr. Hess and Clark Laboratories.

49. Observation on the Life History of a Rabbit Cuterebrid, the Larvae of Which May Penetrate the Human Skin. (12 min) (Lantern) RAYMOND H. BEAMER, University of Kansas, AND LAWRENCE R. PENNER, University of Connecticut.

50. On the Structure of So-Called "Stigmata" of Larval Ticks. (5 min) (Lantern) HAROLD ELISHEWITZ, University of Minnesota.

51. The Taxonomy of the Pathogenic Rickettsiae. (10 min) (Lantern) CORNELIUS B. PHILIP, Army Medical School.

52. Age as a Factor in the Resistance of Splenectomized Rats to Infection with *Bartonella muris*. (10 min) (Lantern) WALTER R. KESSLER, Columbia University, and College of the City of New York.

53. The Pathogenicity of Three Strains of *Trichinella spiralis* as Indicated by Lethal Dose and Survival Time. (15 min) (Lantern) IRVING RAPPAPORT, Cornell University.

54. Tests for a Hemolytic Substance in *Chabertia ovina*. (15 min) (Lantern) W. L. THRELKELD, Virginia Agricultural Experiment Station.

55. Factors Influencing the Oxygen Consumption of a Larval *Eustrongylides*. (10 min) (Lantern) THEODOR VON BRAND, Catholic University of America.

By Title

56. Survival on Soil of Oöcysts of Two Species of Swine Coccidia, *Eimeria debliecki* and *E. scabra*. JOHN LAWRENCE AVERY, United States Bureau of Animal Industry.

57. The Effect of Moderately Low Temperatures on the Sporulation of Oöcysts of Two Species of Swine Coccidia. JOHN LAWRENCE AVERY, United States Bureau of Animal Industry.

58. The Segmental Anatomy of *Mesocestoides variabilis* Mueller, 1928, from *Didelphis virginiana* Kerr. ELON E. BYRD, University of Georgia, AND JAMES W. WARD, Mississippi State College.

59. Notes on the Genital System of the Bird Fluke, *Apharyngostrigea cornu* (Zeder). ELON E. BYRD, University of Georgia, AND JAMES W. WARD, Mississippi State College.

60. The Parasites of the Caecilidae (Amphibia : Apoda). A. C. WALTON, Knox College.

61. The Parasites of the Cryptobranchoidea (Amphibia : Caudata). A. C. WALTON, Knox College.

62. The Parasites of the Ambystomoidea (Amphibia : Caudata). A. C. WALTON, Knox College.

63. The Possibility of Chemical Control of the Snail Intermediate Hosts of *Schistosoma mansoni* in Venezuela. II. GEORGE W. LUTTERMOSER, Instituto Nacional de Higiene, Caracas, Venezuela.

64. A Peculiar Larval Development of *Rhabdochona* spp. (Nematoda : Spiruroidea). PAUL V. GUSTAFSON, Whitworth College.

By Invitation

65. African Sleeping Sickness. (30 min) (Lantern; motion picture) EUGENE R. KELLERSBERGER, American Mission to Lepers, New York (Tuesday, December 29, 4:00 P.M.; Room 919, Hunter College.)

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SYMPOSIUM ON TROPICAL DISEASES

Program of Section N (Medical Sciences) of the A. A. A. S., Organized in Cooperation with the American Society of Parasitologists, the National Malaria Committee, the American Society of Tropical Medicine, and the New York Society of Tropical Medicine

NEW YORK, NEW YORK

TUESDAY, DECEMBER 29, 1942

PROGRAM[2]

MORNING SESSION, DECEMBER 29, 9:30 A.M.; HOTEL COMMODORE.

1. Tropical Diseases and Military Medicine. COLONEL JAMES S. SIMMONS, Office of the Surgeon General, War Department, Washington, D.C.

2. The Implications of Tropical Medicine to the Civilian Population. RICHARD P. STRONG, Army Medical School, Washington, D. C.

3. The Teaching of Tropical Medicine in the United States. LIEUTENANT-COLONEL THOMAS T. MACKIE, Army Medical School, Washington, D. C.

4. The Role of Tropical Medicine in International Affairs. ALAN GREGG, Rockefeller Foundation, New York, N. Y.

5. THE THEOBALD SMITH AWARD. Presentation by PRESIDENT COMPTON of the A. A. A. S. Address by Recipient.

AFTERNOON SESSION, DECEMBER 29, 2:00 P.M.; HOTEL COMMODORE.

6. Dysentries and Diarrheas—Their Importance in the Military Service. COLONEL G. R. CALLANDER, Army Medical Center, Washington, D. C.

7. Relapsing Fever. MALCOLM H. SOULE, University of Michigan Hygienic Laboratory, Ann Arbor, Michigan.

8. Malaria Control. LOWELL T. COGGESHALL, University of Michigan Institute of Public Health, Ann Arbor, Michigan.

9. Yellow Fever. WILBUR A. SAWYER, Rockefeller Foundation, International Health Division, New York, N. Y.

ADDRESS OF VICE PRESIDENT OF SECTION N

10. The Man Who Lived for Tomorrow. WADE W. OLIVER, The Long Island College of Medicine, Brooklyn, New York.

EVENING SESSION, DECEMBER 29, 8:30 P.M.; HOTEL COMMODORE.

THEOBALD SMITH LECTURE OF THE NEW YORK SOCIETY OF TROPICAL MEDICINE

11. Typhus Fever. M. RUIZ CASTAÑEDA, General Hospital, Mexico City, Mexico.

[2] No abstracts.

ABSTRACTS

AMERICAN SOCIETY OF PARASITOLOGISTS' PROGRAM

1. *Development of the Metacercariae of* Diplostomum flexicaudum *in the Lenses of Frogs, Turtles, Birds, and Mammals.* M. S. Ferguson, Rockefeller Institute for Medical Research.

Frog tadpoles, frogs, turtles, chicks, ducklings, and laboratory white mice, rats, guinea pigs, and rabbits were exposed to the cercariae of the strigeid trematode *Diplostomum flexicaudum.* The cercariae were able to penetrate the eye and grow in the lenses of every species. The metacercariae which developed were normal in appearance and behavior and were similar to those found in the eyes of fishes, the normal intermediate hosts. There was usually a considerable variation in size among metacercariae from each particular lens as well as among metacercariae from the eyes of different species of animals. Similar size variations were found in metacercariae from the eyes of fishes. Metacercariae from the lenses of a frog and a guinea pig were infective for baby chicks, and normal adult trematodes with eggs were recovered from them after one week. Blindness was caused in many of the infected eyes. Initial damage resulted in an opacity of the cortex and nucleus of the lens. In some cases the cortical substance later became partially liquified. Diseased lenses usually were evident earlier, and due to fewer larval trematodes, in the warm-blooded animals than in the cold-blooded ones. Certain experiments and an apparent complete lack of records in medical literature suggest that the possibility of these metacercariae causing disease in man is rather remote. However, it remains to be proved that such a danger does not exist.

2. *The Occurrence of* Cercaria clausii *Monticelli, a Marine Rattenkönig Cercaria, on the West Coast of Florida.* Raymond M. Cable, Purdue University, and Richard A. McLean, Academy of Natural Sciences of Philadelphia.

A marine rattenkönig cercaria has been found to parasitize a species of *Lamellaria* collected near Captiva Island, Florida. This larva agrees in all essential respects with *Cercaria clausii,* the only known marine larval trematode of this type and hitherto reported only from the Adriatic region. The cercariae develop in simple daughter rediae in the digestive gland of the snail. Very small mother rediae in the mantle produce daughter rediae one at a time. There is no indication of rosette formation within the daughter redia; the cercariae develop singly just as do other species. Since there are many fundamental differences between *C. clausii* and *C. gorgonocephala,* the only known species of freshwater rattenkönig cercaria, it appears that rosette formation may not indicate close affinities but instead a larval adaptation that may arise independently in distantly related groups. The discovery of a pharynx in *C. clausii* removes the possibility that this species is the larva of *Phyllodistomum acceptum,* a marine gorgoderid, as claimed by Odhner. *C. clausii* possesses several characters in common with the trichocercous cercariae, viz., eyespots, a well-developed ventral sucker, a sac-shaped, thick-walled excretory bladder, and hair-like processes on the tail. For this reason, the adult stage probably should be sought among fish parasites belonging to the family Lepocreadiidae or the closely related family Gyliauchenidae.

3. *The Life Cycle of* Zoogonoides laevis *Linton, 1940.* Horace W. Stunkard, New York University.

Sexually mature specimens of *Zoogonoides laevis* occur regularly and abundantly in the intestine of *Tautoga onitis.* Eggs in the uterus have membranous coverings but no shells, and when passed they contain active miracidia. The larvae emerge almost immediately in sea water and *Mitrella lunata* serves as the first intermediate host. There are at least two generations of sporocysts, the last of which produces cercariae. The cercariae are terete, tailless, with spined cuticula, simple stylet, anterior setiferous papillae, acetabulum slightly larger than oral sucker,

numerous penetration and cystogenous glands. The flame cell pattern is [(2+2)+(2+2)]. Snails were infected in the laboratory and at the end of seven weeks, although they contained young cercariae, they had not yet produced mature cercariae which could be used to complete the cycle. But cercariae from naturally infected snails encysted readily in *Nereis virens*. *Nereis* exposed to cercariae for two weeks were fed to tautogs which had been isolated for seven weeks. The fishes were dissected two days later and many young *Z. laevis* were recovered. These small specimens were clearly distinguishable from larger specimens of natural infection which were present in the intestine of the fish when they were caught.

4. *The Dorso-Ventral Axis in* Taenia pisiformis. JUSTUS F. MUELLER, New York State College of Forestry.

It is generally stated in standard reference works that one entire surface of the cestode strobila may be considered ventral, the other dorsal, and that the ovary lies nearest the ventral surface. In the taenias two pairs of longitudinal excretory vessels occur. The two larger excretory vessels, connected near the posterior margin of each proglottid, are usually designated as the ventral excretory vessels. The smaller vessels, without transverse connections, are usually designated as dorsal. In a restudy of the anatomy of *Taenia pisiformis* from the dog it was discovered that these relationships are inconstant. Using the ovary to determine orientation, in few proglottids do the large excretory trunks lie ventrally. The most frequent condition is with the large canal ventral to the small canal on one margin, dorsal to it on the other, with the transverse connections passing diagonally. In other cases both small vessels lie ventral in position, the large canals dorsal. In certain instances the ovary reverses its position with reference to the surfaces of the strobila in adjacent proglottids, thus reversing the dorso-ventral axis. It is clear, therefore, that neither the relationship of the excretory canals to each other, nor the orientation of the dorso-ventral axis is constant throughout the length of the strobila. Nor can any character be found that bears any constant relationship to one surface or the other. It is impossible, therefore, in *T. pisiformis* at least, to differentiate between the two surfaces of the strobila, or to designate either surface as dorsal or ventral.

5. Stempellia moniezi *n. sp., a Microsporidian (Protozoa: Sporozoa) Parasite of Cestodes.* ARTHUR W. JONES, University of Virginia.

In two cestodes, *Hymenolepis anthocephalus* Van Gundy, 1936, and *Diorchis reynoldsi* (description in press), taken in 1941 from the intestine of the shrew, *Blarina brevicauda* Say, 1823, a protozoan parasite was found. The previous reports of protozoa from the cestodes were made prior to 1900, and are not sufficiently detailed to classify properly any of the reported forms. In recognition, however, that Moniez (1887) gave the first name and description (although inadequate) to a protozoan parasite of cestodes, the new species is named in his honor.

The protozoon infects the parenchyma of its cestode host, lying chiefly near the excretory ducts. Its spores, of general size 4.0–5.0 micra by 1.5–2.0 micra, are thin-walled, subcylindrical. They develop singly or in groups of two, four, and eight, from a single sporoblast; a size gradation is evident, the spores of a group of eight being the smallest, as is characteristic of the genus *Stempellia* Leger et Hesse, 1922, (of the Family Nosematidae Labbé, 1899, Order Microsporidia Balbiana, 1882), according to Kudo (1924). It is suggested that the infection of cestodes is accidental, and that the normal host of this protozoon may be, as is usual in the Nosematidae, a larval insect.

6. *Intestinal Parasitic Infections in a State Mental Hospital, and Control with Aluminum Hydroxide and Colloidal Kaolin.* HERMAN A. SHELANSKI, W. L. PIOUS AND JESS H. FRANK, University of Pennsylvania and the Philadelphia State Hospital.

In a routine study of the bloods of several hundred patients at the Philadelphia State Hospital it was found that an unusually high number of patients showed a

markedly high eosinophilia, a sign indicative of infection of a parasitic nature. It was then decided to make fecal examinations of the patients showing this high eosinophilia in order to determine whether or not there was present any gastro-intestinal infection.

After fecal examination was made it was found that all of the patients who showed a markedly high eosinophilia were infected with one or more species of parasites. The following types of infection were found: *Trichuris trichiura, Oxyuris vermicularis, Ascaris lumbricoides, Strongyloides stercoralis, Hymenolepis nana, Endamoeba histolytica, Endamoeba coli, Endolimax nana, Iodamoeba bütschlii, Dientamoeba fragilis, Retortamonas hominis, Chilomastix mesnili, Giardia lamblia,* and *Trichomonas intestinalis.*

A suspension of aluminum hydroxide and colloidal kaolin was used in these cases to rid them of these infections. The patients were given three one-ounce doses daily. This medication was continued for a period of three to four weeks with examinations being made at weekly intervals during this period. At the end of this time fecal examinations made every week for a period of four to eight weeks showed that most of these cases were free of parasites. The only organism which persisted was *Trichuris trichiura,* since on repeated examination ova of this parasite were found in the feces.

7. *Anaerobiosis and Cholesterol as Growth Requirements of* Endamoeba histolytica. Thomas L. Snyder and Henry E. Meleney, New York University.

A study of the growth requirements of *Endamoeba histolytica* is being conducted with cultures of the motile amoebae containing bacteria. A fluid medium consisting of a saline infusion of coagulated whole egg produced satisfactory growth under aerobic conditions and was used as a basis for studying individual requirements. Since excystation in sterile media occurred only under anaerobic conditions it seemed advisable to study the motile amoebae under similar conditions. Successive anaerobic transplants to sterile egg infusion medium were unsuccessful, apparently because of a decrease in the bacterial flora. They were successful, however, when the medium was seeded with the original bacterial flora and incubated aerobically for 24 hours prior to transplanting the amoebae for anaerobic cultivation. Subsequently it was found that a reducing agent (cysteine) could be substituted for the additional bacteria thus furnished, and that peptone in Ringer's solution plus cholesterol (1 part per million) could be substituted for the fluid portion of the culture. Rice starch was necessary in all anaerobic cultures. Exposure of anaerobic cultures to air for approximately one hour caused death of the amoebae, thus confirming their strict anaerobic requirements. The anaerobic amoeba cultures in this peptone-Ringer-cholesterol-cysteine-starch medium contain a diminished bacterial flora which furnishes some undiscovered substance or condition necessary for the cultivation of *E. histolytica.* This flora has been further simplified by obtaining a successful anaerobic amoeba culture from bacteria-free cysts with a single species of anaerobic bacillus recovered from the original amoeba culture.

8. *Studies on Reducing Substances and Gas Formation in Cultures of* Endamoeba histolytica *and a Single Species of Symbiotic Bacteria.* Theodor von Brand, Charles W. Rees, Leon Jacobs and Lucy V. Reardon, National Institute of Health.

Using the micro-method of Hagedorn and Jensen, it was found that the raw egg emulsion of the L.E.S. medium contains 278 to 312 mgm per cent of reducing substances. In tubes, diffusion of these substances from the egg slant to the saline overlay takes place over a period of a week, with a final concentration in the liquid of about 50 mgm per cent; diffusion in flasks is much more rapid. In media to which glucose in amounts up to 300 mgm per cent was added to the overlay, the diffusion was less rapid and of less degree. In cultures of *Endamoeba histolytica* grown with a single bacterial symbiont and in cultures of the symbiont alone, to neither of which glucose was added, the reducing substances were almost completely

utilized, leaving only 7 to 19 per cent after 24 hours. In media with glucose in the overlay, most of the sugar was utilized in 24 to 48 hours. No differences could be detected in utilization of reducing substances in cultures of the amoeba and the bacterium or in cultures of the bacterium alone. In the presence of glucose, gas was produced in like amount and composition in cultures of the bacterium alone and in cultures of the amoeba plus the bacterium. The predominant constituent was hydrogen (70.1 to 74.7 per cent), indicating an anaerobic metabolism. The other gases were CO_2 (11.2 to 18.9 per cent), O_2 (0.3 to 1.3 per cent), N_2 (5.9 to 14.1 per cent), and CH_4 (0.2 to 1.3 per cent).

9. *Morphological Characters of the Trichomonad Flagellates of Man.* DAVID H. WENRICH, University of Pennsylvania.

Trichomonas vaginalis Donné, largest of the trichomonads of man, has 4 anterior flagella; costa and undulating membrane are one-third to two-thirds of the body length; marginal filament is double; there is no trailing flagellum. Parabasal apparatus consists of a long parabasal fibril and a shorter, sausage-shaped parabasal body; a shorter, additional parabasal body is often seen in some populations. The relatively slender axostyle may split into 2 or more splinters in larger individuals. Nucleus is usually elongated, with a small endosome. Cytoplasm of stained specimens generally contains many chromatic granules.

T. tenax (O. F. Müller) from the mouth is smaller but similar to *T. vaginalis* in organization. It has 4 anterior flagella, less-than-body-length costa and undulating membrane, double marginal filament, parabasal fibril and parabasal body, and slender axostyle. Nucleus is usually rounded. Fewer chromatic granules occur in the cytoplasm.

T. hominis (Davaine) from the intestine is intermediate in size; has 4 or 5 anterior flagella; costa and undulating membrane are body-length; marginal filament is double; trailing flagellum present; and at least one row of paracostal granules; parabasal apparatus not yet identified; axostyle relatively coarser than in two above species. Similar and apparently identical forms occur in monkeys, dogs, cats and rats.

T. fecalis Cleveland has 3 long anterior flagella; body-length costa and undulating membrane; double marginal filament; long trailing flagellum; two or more rows of paracostal granules; axostyle relatively thick, dense and long. It is similar, if not identical to *T. batrachorum* (?) from frogs and toads.

10. Trichomonas vaginalis *in Tissue Cultures.* M. J. HOGUE, University of Pennsylvania.

Dr. Trussell's pure culture of *Trichomonas vaginalis* was introduced into tissue cultures of chick embryo intestine. This movie shows the trichomonads swarming along the cut edges of the embryonic tissues and entering the lumen of pieces of the intestine. Many individuals clump together to form rosettes. The trichomonads attach themselves with their axostyles to epithelial cells and whirl about on them. They wander about in a plexus of sympathetic nerves, resting on the nerves with their axostyles. In feeding over the tissue culture cells they often send out a proboscis-like structure containing the flagella and undulating membrane. In the hanging drop they drag and push about the plasma granules. They do not mechanically injure the tissue culture cells.

11. *Report on the* JOURNAL OF PARASITOLOGY. NORMAN R. STOLL, Rockefeller Institute for Medical Research.

A five-year perspective, and the impact of the war viewed from the office of the Chairman, Editorial Committee.

12. *The Life Cycles of Three Dermatitis-Producing Cercariae (Trematoda: Schistosomatidae).* DONALD B. MCMULLEN, Michigan Stream Control Commis-

sion and University of Oklahoma, AND PAUL C. BEAVER, Michigan Stream Control Commission.

Adult schistosomes and ova were obtained in experimental animals exposed to *Cercaria stagnicolae* Talbot, *Cercaria elvae* Miller and *Cercaria physellae* Talbot. The worms reached maturity in birds exposed for 8–25 days to the cercariae in drinking water. Experiments indicated, however, that the cercariae can also penetrate the external surface of birds and establish infections. In 25–48 days after exposure to *C. stagnicolae* trematodes belonging to the genus *Trichobilharzia* Skrjabin and Zakharow were recovered from the peripheral veins of the intestine of two canaries. Embryonated ova were numerous in the gut. A Caspian tern, chickens, domestic ducklings, mallards, and gulls exposed to the cercariae were negative. Great numbers of another *Trichobilharzia* sp. were found in the venous plexus of the intestinal mucosa and extending into the villi of two mallards, five domestic ducklings, and two canaries exposed to *C. elvae*. Fully embryonated ova appeared about two weeks after exposure. The ducks were much more susceptible than the canaries. In experiments with a Caspian tern, pigeons, and chickens, the worms failed to mature. Trematodes belonging to the genus *Pseudobilharzia* Ejsmont were recovered in large numbers from the peripheral veins of the intestine and the venous plexus of the submucosa in two pigeons, two mallards, and three canaries 2–4 weeks after exposure to *C. physellae*. In one heavily infected canary large numbers of ova and 300–400 worms were found in the intestine, liver and lungs. A Caspian tern, chickens, domestic ducklings, and gulls exposed to this cercaria were negative.

—13. *Methods of Investigation on the Life Cycles of Avian Schistosomes.* PAUL C. BEAVER, Michigan Stream Control Commission and Georgia Department of Public Health, AND DONALD B. MCMULLEN, Michigan Stream Control Commission and University of Oklahoma.

The experimental birds were exposed by providing daily fresh suspensions of cercariae, *Cercaria stagnicolae* Talbot, *C. physellae* Talbot and *C. elvae* Miller, in the drinking water. Infections were obtained also by immersion in cercarial suspensions, but in well-feathered hosts the breast and leg feathers were removed. To determine the presence of mature infections, to discover light infections at autopsy, and to concentrate miracidia for other experiments, fecal samples were emulsified in small quantities of water in one-liter, vertical side arm distillation flasks. The flasks were then filled to the side arm with tap water, allowed to settle, then completely filled by rapidly pouring into the side arm. A paper bag with a hole just large enough and at the proper level to accommodate the side arm was placed over each flask, leaving the arm exposed to light while the remainder was in darkness. The miracidia, being negatively geotropic and positively phototropic, were readily observed as they collected in the clear water of the side arm. In general the search for the adult worms, fixation, and staining were done in the manner described by Brackett (1942). It was found that the worms were easier to find and remained active for several hours if the vessels were injected with one per cent sodium citrate in physiological salt solution immediately after killing the host. This was done by using a gravity bottle and injecting from the heart until the blood in the tributaries of the mesenteric veins was highly diluted.

—14. *Studies on Cercariae of the Common Mud-flat Snail,* Cerithidea californica. *II. General Infection Data.* WANDA SANBORN HUNTER, University of California at Los Angeles.

The area chosen for detailed study was Anaheim Slough, located on U. S. Highway 101, approximately one mile south of Seal Beach, California. During a 2-year period, 3934 *Cerithidea californica* were brought into the laboratory and detailed study of their cercarial fauna made. Percentages of snails shedding apparently mature cercariae, those harboring parthenitae and maturing cercariae, and the percentages of total infection were determined. Percentages of total infection were

computed by the formula $P=\frac{pN+S}{T}$. P = total percentage; p = percentage of infection obtained by crushing; N = number of snails negative for shedding when isolated; S = number of snails shedding; and T = N + S. For the 2-year period, high peaks in total infection were found in April and in November. The peaks are explained by environmental factors such as temperature (which plays a minor rôle in this region), the daily tides, rainfall, salinity of water, and bird migrations.

The percentage of infection in the entire catch for all collections was estimated as 32.6. However, there was too great a variation from month to month to assume a constant percentage of infection. Analysis of the type of infection revealed that 33 per cent were pleurolophocercous cercariae, 18 per cent echinostomes, 18 per cent xiphidiocercariae, and but 6.5 per cent were furcocercous forms. Correlations between the amount of infection found in the aforementioned groups and environmental factors were made. Five and one-half per cent of the infected snails yielded multiple infections. Comparisons were made between Anaheim Slough collections and those from 3 other areas in Southern California.

15. *Taxonomic Value of the Tooth Formula of* Xironodrilus (*Branchiobdellidae*). Clarence J. Goodnight, University of Illinois.

Additional material studied has enabled the writer to evaluate the taxonomic importance of the teeth formulae of the genus *Xironodrilus*. Ellis (1919) while studying numerous specimens of *X. pulcherrimus* Moore found many individuals which had a 4–4 to a 5–5 tooth formula rather than the 3–3 of the type. Ellis considered these as variations in a single species. Studies by the writer (1940) persuaded him that actually two subspecies were represented: *pulcherrimus* and *dentatus*. Further material has shown these differences to be constant; so that actually two species, rather than one variable one had to be considered. A new eastern species encountered exhibited the same tooth formula as *X. pulcherrimus;* however the relative size of the teeth differed. Thus the writer has come to the conclusion that even in a genus with such variable teeth formulae as *Xironodrilus,* species differences may be recognized by the formula and the relative sizes of the teeth.

16. *Hydrogen-ion Concentration of Amoebic Ulcers.* Gordon H. Ball, University of California at Los Angeles.

By the use of the capillary glass electrode, it is possible to determine the hydrogen-ion concentration of amoebic ulcers in live kittens and to compare this reading with that of the normal gut wall in the same animal or with that of wounds produced mechanically. In any one animal, an amoebic ulcer or a mechanical wound in the cecum or the colon shows usually a lower pH than does the uninjured wall in the same region of the gut. However, these readings are not beyond the range of the pH changes in the lumen which are found at times in normal animals. It is doubtful if pH differences play a significant role in maintaining *Endamoeba histolytica* in an ulcer instead of in the gut lumen. The pH differences between normal and infected tissue disappear rapidly after the death of the animal.

17. *Intravaginal Survival of Culture* Trichomonas tenax (buccalis) *in man.* Robert M. Stabler, University of Pennsylvania, and L. G. Feo, Jefferson Medical College Hospital.

Fifty human volunteers (25 positive and 25 negative for *Trichomonas vaginalis*) were each given 3 intravaginal implantations of *T. tenax* from culture. Survivals of 48 hours were noted in 2 *T. vaginalis*-positive patients, and 8 survivals of at least this length were noted in those free of *T. vaginalis*. In this latter group 5 were of 48 hours, and one each of 72, 168 and 432 hours, respectively. No permanent vaginal infection with the oral form resulted. Four showed at least a 48-hour *T. tenax* survival after the first implantation, 2 after the second, and 2 not until after the third. In the *T. vaginalis*-free patients, *T. tenax* was present in sufficient numbers to be detected on the wet smear in 3 of the 6 showing survival, while the other 3

were proven positive by culture alone. Three patients (1 with and 2 without *T. vaginalis*) were given intravaginal inoculations directly from the mouth of a person positive for *T. tenax*. No survival was noted at 48 hours. It is concluded that the failure of the oral trichomonad to permanently establish itself in the human vagina after 150 implantations completely supports the morphological studies which indicate that the mouth and vaginal forms are two separate species.

18. *Inoculations of* Trichomonas foetus (*Protozoa*) *in Guinea Pigs.* Banner Bill Morgan, University of Wisconsin.

Sixty-two guinea pigs, divided into 3 groups, were inoculated intraperitoneally with: (1) washed *Trichomonas foetus* suspended in saline with a concentration of 10 million living organisms per cc; (2) liquid portion of 72-hour *T. foetus* cultures composed of buffered saline-citrate solution with 5 per cent bovine serum in which the concentration was approximately 3 million living organisms per cc; and (3) sterile trichomonad pyometra material from an infected cow with a count of 1.5 million living organisms per cc. Only 3 animals became infected. Twenty guinea pigs were refractory to subcutaneous injections of *T. foetus* in pure culture while 12 guinea pigs were positive to subcutaneous injections of sterile trichomonad pyometra material from an infected cow. The abscesses which were produced remained positive for *T. foetus* up to 42 days. Of thirty guinea pigs inoculated vaginally with sterile pyometra material, only 2 animals were positive for 5 days.

19. *Exoerythrocytic Schizogony in a New Species of Saurian* Plasmodium. Paul E. Thompson and Clay G. Huff, University of Chicago.

A new species of *Plasmodium* recovered from Mexican lizards (*Sceloporus ferrariperezi*) and maintained in Texas collared lizards (*Crotaphytus collaris*), in *Sceloporus undulatus,* and in horned toads (*Phrynosoma cornutum*) has the characteristic of *P. elongatum* (of birds) of inhabiting blood cell precursors, including reticular cells, and also is capable of infecting endothelial cells of the brain. It has, therefore, both *elongatum* and *gallinaceum* types of exoerythrocytic schizogonic stages. This suggests that the various species of malarial parasites may have evolved from such a primitive stock and have differentiated into species with different host cell preferences.

20. *The Effects of Thio-Bismol upon Three Species of Therapeutic Malaria.* Martin D. Young, United States Public Health Service, Sol B. McLendon and Roy G. Smarr, South Carolina State Hospital.

Used in induced malaria, 0.1 or 0.2 grams of thio-bismol (sodium bismuth thioglycollate) eliminated the paroxysms caused by broods of *Plasmodium vivax* parasites which were about one-half grown. The range of effectiveness was from 16 to 28 hours after the paroxysm. Parasites of other ages were not consistently affected. Thus it is possible to change the periodicity of paroxysms from quotidian to tertian, which is of considerable value to the neurosyphilitic patient undergoing malaria therapy. Thio-bismol did not exhibit this selective effect upon induced infections of *P. malariae* and *P. falciparum.*

21. *The Mechanism of Quinine Action in Malaria.* Emanuel Waletzky and Harold W. Brown, University of North Carolina.

Various quantitative aspects of the relations between quinine, the host, and the parasite have been studied for their bearing on the problem of the direct versus the indirect action of quinine. The duration of the anti-plasmodial environment following single massive intravenous doses of quinine has been determined. The degree of inhibition of asexual reproduction in *Plasmodium, lophurae* introduced into ducks at different intervals following quinine administration served as the criterion of anti-plasmodial activity. The anti-plasmodial activity has been correlated with the blood and tissue levels of quinine present at similar intervals following single intravenous

doses of quinine in the duck. The minimal length of time necessary for in vivo action of quinine has also been studied. In this case, the administration of quinine was followed by the inoculation of the parasites, which were then withdrawn and introduced into clean birds. The in vitro effect of different quinine concentrations, acting for similar lengths of time, has been studied and compared with the in vivo results.

22. *The Influence of Biotin upon Susceptibility to Malaria.* WILLIAM TRAGER, Rockefeller Institute for Medical Research.

Young ducks and chickens were rendered biotin-deficient by feeding them diets containing 25 per cent dried egg white. Control animals were kept on similar diets which contained casein in place of the egg white. In some experiments animals were fed the high egg white diet plus enough biotin concentrate to provide an excess of biotin. After intravenous inoculation with blood infected with the avian malaria parasite, *Plasmodium lophurae,* the biotin-deficient animals regularly developed more severe infections than the controls. For example, in one experiment in which the chickens were 22 days old when they were inoculated, the peak parasite numbers for 12 chickens kept on an egg-white diet and showing typical signs of biotin deficiency were (per 10,000 red cells) : 5940, 2420, 2100, 1440, 4000, 1660, 1080, 3280, 2940, 2660, 3680 and 5960, while the peak parasite numbers for the 6 control chickens were: 880, 1180, 800, 1440, 4000 and 1120. While 9 of the 12 chickens in the egg-white group had peaks of over 2000, this was true of only 1 of the 6 chickens in the casein group. Pantothenic acid-deficient chickens, although in as poor condition as biotin-deficient chickens, showed perhaps somewhat less severe infections than control chickens on a complete diet. This result indicates that the more severe infections which developed in biotin-deficient animals were specifically associated with the low biotin level of the host rather than with any general weakness produced by the biotin deficiency.

23. *The Coccidial Nature of "Avian* Toxoplasma." FREDERICK COULSTON, University of Chicago.

Nöller (1920) suggested that certain *Toxoplasma* of birds could be coccidial merozoites. Manwell and Goldstein (1938) demonstrated differences in morphology and host infectivity between avian and mammalian types of *Toxoplasma.* Celloidin sections of tissues fixed in Zenker-formalin and stained by the Maximow method, revealed that the so-called *Toxoplasma* of English sparrows, captured in Syracuse, N. Y., was probably the result of a coccidial infection of the intestine having no apparent relationship with classical *Toxoplasma.* Coccidial merozoites were observed in lymphocytes, monocytes and macrophages. They occurred in large numbers in the intestine, spreading via the blood, in which they were observed, to the spleen, liver, lungs, brain and kidney. In these organs, parasites were found localized in small areas.

A detailed study of *Toxoplasma* (Sabin's strain) in mice disclosed no coccidia-like stages. The parasites were observed in lymphocytes, monocytes, macrophages (lymphoid-macrophage system), heterophils and in epithelial cells of many organs where actual destruction occurred. Classical toxoplasmosis in mice was primarily a generalized infection of the subcutaneous tissues while the avian coccidial infection was localized. On a coccidial basis, the infection of the sparrow explained many problems, especially the inability to transmit the parasite from bird to bird. Mammalian type *Toxoplasma* can be easily given to birds by inoculation.

True *Toxoplasma* in birds has been reported in South America and other countries but there is no actual record of it in the U. S. A. If a parasite reservoir exists in northeastern United States, it is probably in some other animal, such as the rat or mouse. Olafson and Monlux (1942) report that sheep, dogs, and cats may be naturally infected in New York State.

24. *Maintenance of Human* Toxoplasma *in Chicken Embryos.* FRUMA WOLFSON, Johns Hopkins University.

The strain of *Toxoplasma* used was the original "BD" strain isolated from a child in New York City by Wolfe, Cowen and Paige in 1939. The present summary is based on 2 series of chicken eggs, each consisting of (a) 9 consecutive subinoculations and (b) several successive collateral passages. From 2 to 16 eggs were used for each subinoculation. The age of these eggs was from 7 to 13 days. About 20 organisms per egg were found sufficient to produce the infection; the actual numbers used were up to 200. The suspension in physiological salt solution of *Toxoplasma* obtained from the infected chorio-allantoic membrane of a single egg, was inoculated (under the chorio-allantoic membrane) into the succeeding set of eggs. After the inoculation, the eggs were reincubated for 7–9 days before the next subinoculation.

Chicken eggs, which were inoculated with human *Toxoplasma,* developed macroscopic lesions on the chorio-allantoic membranes similar to those previously observed (Wolfson, 1941) in duck eggs inoculated with the guinea pig strain of *Toxoplasma.* These lesions appeared about 5 days or later after inoculation, depending on the size of the inoculum used. The liver and spleen of the infected embryos sometimes were necrotic and contained *Toxoplasma.* The lungs were also found to contain parasites. After seven passages through eggs, *Toxoplasma* produced infections in mice.

It seems of particular importance to note that *Toxoplasma* was consistently found in the erythrocytes of infected embryos.

25. *Minimum Heat Treatment Required for the Destruction of Trichinae in Pork Scraps in Garbage.* Willard H. Wright and John Bozicevich, National Institute of Health.

Tests were carried out by introducing into garbage cooked by steam in an open tank pieces of trichinous pork varying in dimensions from $1\times1\times1$ inch to $6\times6\times4.5$ inches and in weight between 20 and 2,297 grams. In one series the samples were held in the tank for respective periods of 10, 15, 20 and 30 minutes after the garbage came to a boil. In a second series, the steam was turned off after the garbage had boiled for 30 minutes and the samples were removed 60 minutes later. In the first series considerable variation was noted in the degree of internal heat reached in the pieces of pork and such variation was not always correlated with the size of the sample or the length of cooking. The variation was no doubt due to the fact that the temperature throughout the mass of garbage was not uniform. In the second series, all larvae were killed in all samples with the exception of the largest, which measured $6\times5\times4$ inches and weighed 2,056 grams. In both series no larvae survived when the internal temperature of the sample reached 56° C. It is concluded that the boiling of garbage for 30 minutes in an open container will effect destruction of trichina larvae in pieces of pork up to 3 inches in thickness and probably in pieces of pork of greater thickness provided the garbage is allowed to cool gradually. Such procedure would thus prevent the transmission of trichina infection to garbage fed hogs.

26. *The Rôle of Parasitologists in World War II.* Henry E. Meleney, New York University College of Medicine.

Presidential address.

27. *The Effect of Long Ultraviolet and Near Visible Radiation on the Eggs of the Nematodes,* Enterobius vermicularis *and* Ascaris lumbricoides. Myrna F. Jones and Alexandér Hollaender, National Institute of Health.

Eggs of the nematodes, *Enterobius vermicularis* and *Ascaris lumbricoides,* were exposed to high intensities of near ultraviolet and short visible radiation in the range of 3500 to 4900 Å. No ultraviolet shorter than 3500 Å reached the eggs and all infrared radiation was filtered out. The most intense lines were the 3650 Å group of the Hg spectrum; next in intensity was the 4046 Å group; then the 4358 Å group and some minor lines. The intensity approximated 7.5×10^6 ergs/cm^2/minute. It was

similar in intensity to this wavelength range in tropical sunlight. These are wavelengths not absorbed by most colorless window glass. Times of exposure varied from 45 minutes to 5 hours. Eggs of *E. vermicularis* were in the infective stage; effect of irradiation was judged by the subsequent ability of active larvae to hatch in artificial gastric juice. Most eggs of *A. lumbricoides* were irradiated in the one-cell stage but some were in a late segmentation stage and a few were embryonated; effect was judged either by ability to complete development or by activity of the vermiform embryo. Lethal effects were observed after irradiation with sufficient energy. Much more energy was necessary to kill at 3500 to 4900 Å than with ultraviolet shorter than 3000 Å. A delay in development of *A. lumbricoides* was apparent after some exposures. Tests with *E. vermicularis* indicated a temperature factor, increasing temperature apparently enhancing the effect of irradiation. These experiments are of interest in connection with numerous reports on the effectiveness of sunlight in destroying nematode eggs, especially eggs of the various ascarids.

28. Phyllodistomum etheostomae *n. sp.* (*Trematoda: Gorgoderidae*) *from Percid Fishes.* Jacob H. Fischthal, University of Michigan.

Three of 20 northern greenside darters, *Etheostoma b. blennioides,* collected from the Huron and Saline Rivers, one of 21 blackside darters, *Hadropterus maculatus,* and one of 23 northern logperch, *Percina caprodes semifasciata,* collected from Honey Creek, all in Washtenaw County, Michigan, were found to harbor in their urinary bladders a total of 6 mature and 2 immature specimens of *P. etheostomae.* Average measurements of 5 mature worms: Body 1.766 × 0.738 mm; oral sucker 0.258 × 0.228; acetabulum 0.188 × 0.194; vitellaria 0.138 × 0.082; ovary 0.146 × 0.139; anterior testis 0.148 × 0.122; posterior testis 0.178 × 0.129. Posterior portion of body thrown into two marginal folds. Intestinal crura end at posterior fourth of body; lined with a conspicuous layer of cells. Ovary equal to either testis or larger. Uterus intra- and extracecal. Eggs 0.031 × 0.022 mm. Testes irregularly lobate; indentations deeper and lobes more numerous than in ovary. The present species most closely resembles *P. brevicecum* and *P. pearsei* from which it is readily distinguished by several characteristics.

29. *Increased Mortality in Rats with Concomitant Dual Infections.* Graeme A. Canning and John M. Fisher, University of Tennessee.

In order to establish a measure of the fatality of dual infections over single infections, sub-lethal doses of *Trichinella spiralis* were given to white rats and on the same day these were inoculated intraperitoneally with a strain of *Trypanosoma lewisi.* Twenty-two rats thus infected along with controls bearing single infections showed that dually infected rats frequently succumbed to the infection on or about the 14th day following inoculation with *Trypanosoma lewisi* and the feeding of *Trichinella spiralis.*

30. *The Effect of Dry-Heating the Ration on Oöcyst Production in* Eimeria nieschulzi *Infections.* Elery R. Becker, Iowa State College.

Dry-heating either the wheat middlings or the crude casein, or half of the crude casein, in a ration with but these 2 protein-containing ingredients, significantly reduces the number of oöcysts eliminated by rats during *Eimeria nieschulzi* infection. Feeding pantothenate to rats receiving dry-heated crude casein in the ration significantly increases the numbers of oöcysts eliminated. The substitution of vitamin-free casein for dry-heated crude casein produces practically the same effect as dry-heated casein on numbers of oöcysts eliminated, but the rats do not grow so well.

31. *Effect of X-Irradiation upon the Resistance of Rats to* Trypanosoma lewisi. Dorothy Neuhof Naiman, Hunter College and Columbia University.

Bartonella-free albino rats of different ages were used to determine whether X-irradiation would affect resistance to *Trypanosoma lewisi* infection. The maxi-

mum X-ray dosage which permitted the survival of normal, uninfected rats for 28 days was previously found to be 300, 400, 500, and 500 r, respectively, for 15-, 25-, 35-, and 60-day-old rats. Forty-six rats were employed in the critical experiment, 2 litters being used for each age group. Of each litter, some rats were irradiated only, some infected only, and some both irradiated and infected. Within one hour of exposure, all rats to be infected received from 10,000 to 150,000 trypanosomes in blood-broth suspension, intraperitoneally, all the rats of each age group receiving the same dose. The course of the subsequent infection was followed by counting the number of trypanosomes in the circulating blood at frequent intervals, in most cases on alternate days. Rat weights were recorded and leucocyte counts made at the same time, and blood smears were taken for subsequent estimation of the proportion of dividing parasites. It was found that the peak of the infection was significantly higher and the infection lasted longer in the irradiated members of each series than in the control rats. The only deaths which occurred were in the irradiated groups. Thus it appears that X-irradiation lowers the resistance of rats to *T. lewisi* infection.

—32. *Number of Larvae and Time Required to Produce Active Immunity in Rats against* Trichinella spiralis. Jacob H. Fischthal, State University of Iowa.

Fourteen of 16 rats given either 80, 160, 320 or 640 larvae of *Trichinella spiralis* and a test dose of 10,000 larvae 7 days after the initial infection died between the third and eighth days after reinfection. Between 2,592 and 6,828 developing larvae were recovered from their intestines, indicating that no immunity is produced within 7 days after feeding 80 to 640 larvae. The two similarly infected rats which survived the test dose had in some way been able to resist the effects of the latter. On the other hand, 15 of 16 rats given either 80, 160, 320 or 640 larvae and a test dose of 10,000 larvae 14 days after the initial feeding survived. Nine of these were killed 7 days after reinfection, and only 1 to 546 developing larvae were recovered from their intestines. Seven of the 9 rats contained less than 33 adults. Definite immunity is herein demonstrated since non-immunized control rats harbored approximately 33 per cent of a 10,000 dose. The numbers of larvae recovered from the muscles of the remaining 7 rats similarly infected showed that immunity had been produced by the initial infection and that the rats were nearly perfectly protected against muscle invasion. Therefore, a single small dose of larvae is capable of producing immunity and a period of approximately 14 days is adequate to develop this immunity. It is noteworthy that after immunization by infection the immunity is effective against the intestinal phase of the parasite.

—33. Trichinella *Skin Tests in Apparently Normal Individuals.* Harry M. Rose and James T. Culbertson, Columbia University.

In a preliminary study *Trichinella* skin tests were performed on 232 second-year medical and dental students, most of whom were males from 22 to 26 years of age. The tests were carried out by injecting 0.1 cc of a 1–1000 dilution of *Trichinella* antigen intradermally, and recording the results at the end of 15 minutes. Reactions were considered to be positive when an urticarial wheal at least 1.0 centimeter in diameter appeared at the site of injection.

Four groups of individuals from two schools were tested. In Group I (School A), 5 of 48 persons were positive (10.4 per cent); in Group II (School A), 2 of 17 were positive (11.7 per cent); in Group III (School A), 9 of 101 were positive (8.9 per cent); in Group IV (School B), 3 of 66 were positive (4.5 per cent). Thus, the incidence of positive skin reactions varied from 4.5 per cent to 11.7 per cent among the groups, with an over-all incidence of 8.2 per cent of positive reactions.

Precipitin tests were also performed with sera from eleven of the nineteen positive individuals, of which five were positive and six were negative.

The results of this study are in accord with those of other investigators, and indicate that a significant proportion of young, apparently healthy individuals have

endured a sub-clinical infection with *Trichinella spiralis*. The need for a survey of the comparative efficiency of the intradermal test, the precipitin test, and the complement fixation reaction in trichiniasis is suggested.

34. *Immunological Studies on a Polysaccharide and Protein Fraction Isolated from* Trichinella spiralis. Leo R. Melcher, University of Chicago.

Polysaccharide and protein antigens were isolated from larvae of *Trichinella spiralis*. These were used for skin testing and serological studies of *Trichinella*-infected rabbits. The polysaccharide was precipitinogenic in high dilutions but did not act as a skin-test antigen except when large amounts were administered (0.5–1.0 mgm). Cross reactions with antiserums against other roundworms such as *Ascaris suum, Nippostrongylus muris* or the larval tapeworm, *Cysticercus taeniaeformis* did not occur with this antigen. This nondialyzable polysaccharide gave a Molisch reaction in extremely high dilutions, furthermore protein tests were negative in relatively high concentrations, and it was nitrogen-free when tested by Nessler's method on a 10-mgm sample.

A protein fraction isolated by alkali extraction of the whole worm material and purified by acid precipitation of nonreactive substances was both precipitinogenic and induced positive skin reactions in high dilutions. This protein fraction was studied in the Tiselius apparatus and its electrophoretic pattern consisted of three components with different mobilities.

35. *Active Immunization of Sheep against Large Single Test Infections of* Haemonchus contortus. Norman R. Stoll, Rockefeller Institute for Medical Research.

Sheep have been protected against large test infections of *Haemonchus contortus* by the parenteral injection of sterilized, exsheathed infective larvae of the same species. Such injected larvae do not wander to the abomasum, but instead induce a state of insusceptibility which may be highly effective against larvae normally inoculated per os in single doses of size sufficient to kill clean controls. Positive results have been secured with a single intraperitoneal or subcutaneous injection made 0 to 11 weeks before test. The studies have re-emphasized also the potency of the protection against *Haemonchus contortus* afforded this host when it is well immunized. Experiments were conducted in the fall and winter with spring lambs reared helminth-free.

36. *Some Preliminary Experiments on a Skin Test for Immunity to the Stomach Worm* Haemonchus Contortus *in the Calf*. Roy L. Mayhew, Louisiana State University.

Preliminary experiments indicate that injection of a saline extract of adult worms produces a positive reaction, indicated by a swelling about the point of injection, in immune animals. No reaction was produced in a nonresistant and an infected animal.

37. *Acquired Resistance to the Gapeworm* Syngamus trachea *in the Turkey and Ring-necked Pheasant*. Louis Olivier, United States Bureau of Animal Industry.

Each of fifteen 49-day-old turkeys received an initial infection of *Syngamus trachea* by swallowing about 10,000 embryonated eggs and larvae. Forty-one days later 7 birds harbored an average of 23 pairs of worms each. Each of the remaining 8 birds swallowed about 5,000 additional eggs and larvae. Fifteen days later each superinfected bird harbored from 0 to 9 pairs (average 2.3) of worms from the first infection as determined by size of worms and lesions; no worms from the second infection were present. Eight previously uninfected controls, fed 5,000 eggs and larvae, harbored 39 to 168 pairs (average 108).

Each of twenty-two 39-day-old pheasants received an initial infection by swallowing about 3,000 eggs and larvae. Forty-one days later 5 birds had lost their worms, except 2 living male worms from which the females had become detached

and lost, and 2 pairs of dead worms. Each of the remaining 17 birds received about 5,300 additional eggs and larvae. Thirteen days later each superinfected bird harbored from 0 to 4 pairs (average 0.7) from the second infection and none from the primary infection. Five previously uninfected controls, fed 5,300 eggs and larvae, harbored 25 to 177 pairs (average 94).

It appears, therefore, that resistance to reinfection with *Syngamus* does not depend upon the presence of large numbers of worms in the trachea at time of reinfection. Moreover, the results of the experiment with pheasants suggest that the resistance persists after the worms have been lost.

38. *Skin Tests in Schistosomiasis Mansoni Patients with Antigen from* Pneumonoeces medioplexus. James T. Culbertson and Harry M. Rose, Columbia University.

Three patients with proved schistosomiasis mansoni were skin-tested with 0.1 cc of a one per cent extract of powdered *Pneumonoeces medioplexus.* All manifested an immediate reaction, consisting of a wheal 1.5 to 3.0 centimeters in diameter with distinct pseudopodia. Twelve persons not infected with schistosomes manifested no reaction when tested with the same extract. Further tests in the patients showed that the one per cent extract could be diluted at least two hundred times yet elicit a skin response. The extract resisted boiling for 10 minutes, and retained most of its activity after being autoclaved. The substance responsible for the reaction was soluble in water, but almost wholly insoluble in alcohol or ether.

Four persons in whom schistosomiasis mansoni had been successfully treated with antimony compounds, respectively, two and one-half, three, four, and six years earlier, were also skin tested. A very slight skin reaction was seen in the patient treated two and one-half years previously. No skin reaction was manifested by the three remaining persons.

39. *Resistance to* Ascaris lumbricoides *L. in Guinea Pigs and the Eosinophilia Associated with Infection.* A. Murray Fallis, Ontario Research Foundation.

Infection with *Ascaris lumbricoides* L. in guinea pigs has been studied in a series of experiments using over three hundred animals. The results confirm and extend those of Kerr and others who have studied this parasite. Heavy infection with *Ascaris lumbricoides* renders guinea pigs almost completely resistant to this parasite for a short time immediately following the infection and partially resistant for at least 15 weeks. The resistance appeared to be more complete in pigs which had previously received three heavy infections at intervals of 10 days or less. Evidence of this resistance was obtained by noting the clinical symptoms produced, the rate of growth of the parasite larvae in resistant versus control animals and the pathology of the liver and lungs in each (the latter was illustrated by Kodachrome pictures), and the number of larvae recovered from the lungs after digestion. Attempts to produce passive resistance by injections of serum from resistant pigs met with limited success only. Heavy infection was accompanied by an eosinophilia which reached a peak in 7–10 days, then declined gradually to normal. The eosinophilia produced in resistant and control pigs has also been followed and compared. Guinea pigs receiving a sublethal infection lost weight from approximately the sixth to eleventh day, after which they began to gain. No marked temperature change was observed in pigs receiving a sublethal infection.

40. *The Relation of Splenectomy and the Resistance of Old Mice to the Mouse Cestode,* Hymenolepis nana *var.* fraterna. John E. Larsh, Jr., Johns Hopkins University.

In connection with studies on the mouse cestode, *Hymenolepis nana* var. *fraterna,* experiments were undertaken to determine the influence of the spleen on natural resistance. Sixty mice (two months old) were selected for an experiment, and 30 were splenectomized. One week after splenectomization, 15 were tested and had about the same percentage development of cysticercoids (about five) as the con-

trols. However, five months later when the other 15 splenectomized mice and controls were infected, there was considerable difference in the percentage development. The controls harbored only a few parasites (0.5 per cent development), whereas large numbers were observed in the splenectomized animals (a 4.5 per cent development). The total number of cysticercoids present in the latter was just slightly less than that in young mice two and one-half months old (included as a check on the viability of the eggs used). Similar results were obtained when the experiment was repeated. The low percentage development in the old controls (seven months old) is a phenomenon which has been observed previously in old mice. In the splenectomized group, latent *Bartonella* infections were manifested three days after removal of the spleen. Periodic hemoglobin (Sahli) determinations showed a gradual development of anemia, probably caused by the *Bartonella*. The hemoglobin level decreased from 101 per cent before the operation to less than 80 five months later, while it remained practically unchanged in the controls. As the anemia progressed, there was a higher percentage development of cysticercoids. Thus this anemic condition seems to be the most plausible explanation for the failure of these mice to develop resistance.

41. *The Effect of* Ascaris suum *Extract Injections upon Chickens Infected with* Ascaridia lineata. L. L. EISENBRANDT, University of Kansas City.

Four subcutaneous injections of dried extract of *Ascaris suum* suspended in physiological salt solution were given in increasing doses on alternate days to half grown white leghorn chickens. The doses were 12, 14, 31 and 56 mg protein. Four days after the last injection 50 ± 5 infective eggs of *Ascaridia lineata* were administered, and three weeks later the chickens were killed and the number and length of *A. lineata* were determined. The control chickens were infected as above.

The injections of *A. suum* extract failed to increase the resistance of these chickens against *A. lineata*. The resistance appeared to be lessened because the experimental chickens averaged 5.3 more nematodes than the control chickens (statistically significant), and the nematodes were longer (2.36 mm, but this was not significant) than those in the controls. Therefore, in this experiment, injections of *A. suum* extract actually lowered the resistance of chickens to *A. lineata* rather than increased it. This study was possible by aid from Sigma Xi research grant and from Dr. J. E. Ackert.

42. *Effects of the Nematode,* Trichostrongylus colubriformis, *on the Nutrition of Lambs.* JOHN S. ANDREWS, W. R. KAUFFMAN AND R. E. DAVIS, United States Bureau of Animal Industry.

The nutrition of the six cross-bred (Hampshire-Southdown) castrated male lambs, of which five were experimentally infected with from 63,000 to 440,000 infective larvae of *Trichostrongylus colubriformis* each, was studied experimentally. One lamb served as an uninfected control for 14 of the 18 weeks during which the infected lambs were under observation. The presence of large numbers of mature trichostrongyles in the infected lambs, indicated by the passage of approximately 1,500,000 worm eggs per 24 hours, for more than a month, apparently did not decrease the digestibility coefficients of any constituent of the feed or interfere with the absorption of calcium and phosphorus except as noted below. In one lamb showing clinical symptoms of trichostrongylosis, and later dying of the disease, the digestibility coefficients of all components of the feed, except ether extract and crude fiber, were decreased when the vitality of the host had been so reduced by partial starvation, and dehydration through continuous diarrhea, that normal digestion and absorption could no longer take place. One lamb that had suffered from anorexia and diarrhea for approximately seven and one-half weeks as a result of *Trichostrongylus* infection lost from the skeleton calcium and phosphorus necessary for the normal metabolism, as shown by analysis of the right femur. The energy metabolism of the infected lambs and the number of pounds of feed necessary for

them to produce 100 pounds of live weight were found to be about twice that required by the uninfected control lambs.

43. *Symptoms and Immunity following Graduated Doses of* Eimeria tenella. HARRY A. JANKIEWICZ, University of Southern California.

Groups of chicks were administered respectively 50, 250, 500, 1,000, 3,000, 6,000, 20,000, and 100,000 oöcysts of *Eimeria tenella*. By employing a sugar solution of specific gravity of 1.065, it was possible to make accurate counts of oöcysts which were uniformly distributed. Daily weight gains, hemorrhage, severity of symptoms, mortality, and the speed of convalescence were the criteria to judge the severity of infection. The chicks fed 50 oöcysts were not harmed. Those fed from 250 to 1,000 oöcysts experienced, respectively, mild to moderate symptoms but no mortality. Weight losses increased as the dosage was raised from 1,000 to 100,000, the latter dosage causing a loss in weight equal to that gained by the controls. Hemorrhage increased as the dosage was raised from 250 to 100,000. Mortalities increased as the dosage was raised from 3,000 to 100,000 oöcysts. Convalescence was more rapid following dosages as high as 6,000 than following those above 20,000. A dosage of 100,000 oöcysts given to each chick eight days after the initial inoculations formed the basis of the immunity rating, the latter being placed on a percentage basis. About a 10 per cent average immunity rating was acquired from 50 oöcysts; a 30 per cent average rating from 250 oöcysts; a 50 per cent rating from 500 oöcysts; 70 per cent ratings from 1,000 to 3,000 oöcysts; and about a 90 per cent average immunity rating from 6,000 to 100,000 oöcysts. Dosage determined the severity of cecal coccidiosis and the average level of immunity developed.

44. *Studies on Susceptibility of Chickens to Cecal Coccidiosis.* C. A. HERRICK AND S. A. EDGAR, University of Wisconsin.

When sporulated oöcysts of *Eimeria tenella* were administered to chickens which had been off feed until their crops were empty, the oöcysts reached the cecal pouches in large numbers in less than an hour. But when chickens with full crops were infected with comparable doses, the oöcysts reached the cecal pouches in two and one-half to four hours. Groups of chickens kept under carefully controlled laboratory conditions were always more susceptible to coccidiosis if infected when their crops were empty. From two to eight times as many chickens died from coccidiosis among those groups infected when their crops were empty as compared with those infected when their crops were filled.

Similar results were obtained when chickens were kept under range conditions. Several groups of chickens were so alternated in naturally contaminated brooder houses that they had identical conditions except that some had feed available when they left the hover in the morning while others were not fed until 8 AM. In those groups which were not fed until 8 AM three times as many died of coccidiosis.

45. *The Magnitude of the Hookworm Problem in a Typical County of Southern Georgia.* J. ALLEN SCOTT AND JUSTIN ANDREWS, Georgia Department of Public Health.

In recent years, differing opinions have been expressed with regard to the present magnitude of the hookworm problem in the southern United States. It is known that the worst areas are in the pine woods sections of the sandy coastal plain. Here the people derive a meager subsistence from cropping small fields and gathering turpentine. Sanitation is virtually non-existent, and diets are extremely inadequate. By means of a house-to-house collection of fecal specimens and determinations of hemoglobins, quantitative data are now available on a cross section of the population of a typical county in this region. Two-thirds of the group between five and twenty years of age were found to be infected, half were passing more than 5,000 eggs per cc (basis formed stools), and 10 per cent were passing more than 40,000 eggs per cc. This latter 10 per cent showed an average hemoglobin of 5 grams as compared with

an average 10.5 grams for non-infected persons in the same family. The problem is only slightly less in younger children. In older persons the prevalence is also high, but the disease only occasionally severe. Statistical methods have been developed to make possible a simple expression of the significance of this problem in terms which can be understood by the layman. For the first time an attempt has been made to visualize the problem on a family basis. It is believed that the information is a step toward more accurate evaluation of the hookworm problem of the South.

46. *Use of Calcium Chloride to Isolate Helminth Ova from Soil.* R. T. Stevenson, University of Wisconsin.

Attempts to recover *Toxocara canis* ova from artificially infected soil samples using recommended methods and flotation media gave erratic results. The possibility of soil particles adhering to the eggs suggested the use of solutions of greater specific gravity than are normally employed. $CaCl_2$ solution (sp. gr. 1.35–1.40) gave consistently better results than $ZnSO_4$ of the same specific gravity or NaCl (sp. gr. 1.20) solution. A comparison of the Willis flotation method and the Lane direct centrifugal flotation technique using $CaCl_2$ solution (sp. gr. 1.35) was made and results showed the latter to be more efficient. Soaking soil samples in 1 per cent solution of $CaCl_2$ over night or in a stronger (10 per cent) solution for at least an hour before attempting to float out the eggs provided even better results. After soaking the sample it was screened to remove coarse debris. The Lane tube containing the sample was attached to a vacuum pump to remove air trapped in the soil. These last two procedures greatly facilitated microscopic examination. Prolonged exposure to the concentrated solution does not appear to destroy ova of *T. canis, Eucoleus aerophilus, Capillaria plica* or coccidia oöcysts but hookworm eggs disintegrate in it rather rapidly.

47. *Phenothiazine in the Treatment of Enterobiasis.* Ella Kuitunen, University of Toronto.

Purified phenothiazine has been used in the treatment of enterobiasis in over 300 children and adults. In approximately 95 per cent of the whole group repeated swabs have failed to show the presence of pinworm infection after one course of treatment covering 5 to 6 days. The NIH swab was used for the detection of infected cases as well as for the post-treatment re-examination. Five swabs on consecutive mornings were taken for diagnosis. The post-treatment swabs were taken on 7 consecutive mornings commencing one week after the last dose of phenothiazine. No laxative was given before, after or during the treatment. Phenothiazine was usually given mixed with food or orange juice.

The following dosage has been used:

Age groups	*Total dosage in grams*	*Daily dose in grams*
2–5	5	1
6–8	6	1
9–11	7.5	1–1.5
12–adults	9	1.5

48. *The Efficacy of Phenothiazine and Nicotine-Bentonite for the Removal of* Heterakis gallinae *and* Ascaridia galli *from Chickens.* James E. Guthrie and Paul D. Harwood, Dr. Hess and Clark Laboratories.

Tablets manufactured from 33 parts phenothiazine, 66 parts nicotine-bentonite (5 per cent nicotine), and 1 part sodium stearate weighed on the average 1.33 grams ($s = 0.029$). Of 16 brown leghorn cockerels, 4 were treated with these tablets, 4 with equivalent amounts of phenothiazine, 4 with equivalent amounts of nicotine-bentonite and 4 were used as untreated controls. The birds receiving tablets of phenothiazine and nicotine-bentonite eliminated 83.7 per cent of 1012 *Heterakis* and 96.2 per cent of 131 *Ascaridia;* those receiving phenothiazine, 89.9 per cent of 675 *Heterakis* and 48.2 per cent of 110 *Ascaridia;* those receiving nicotine-bentonite,

10.1 per cent of 1246 *Heterakis* and 85.2 per cent of 149 *Ascaridia;* those receiving no treatment, 1.1 per cent of 1145 *Heterakis* and 8 per cent of 137 *Ascaridia.* To estimate the toxicity of these tablets, 23 birds weighing from 970 to 1,500 grams were given from 5 to 40 tablets each. All birds survived, but those receiving 20 or more tablets lost weight. To estimate the effect of extreme fineness on the efficacy of phenothiazine, 10 pairs of birds were matched by weight. One bird of each pair was given 150 milligrams of micronized phenothiazine (specially ground as fine as possible) the other was given 150 milligrams of commercial phenothiazine (about 90 per cent of this phenothiazine passes through a screen of 100 meshes to the inch). Birds receiving micronized phenothiazine eliminated 47.9 per cent of 879 *Heterakis;* those receiving commercial phenothiazine eliminated 68.2 per cent of 786 *Heterakis.*

49. *Observations on the Life History of a Rabbit Cuterebrid, the Larvae of Which May Penetrate the Human Skin.* Raymond H. Beamer, University of Kansas, and Lawrence R. Penner, University of Connecticut.

A large, white-sided female cuterebrid collected in a pasture near Lawrence, Kansas, on July 10, 1942, laid numerous eggs in rows up to three-fourths of an inch long on wild lettuce and the sides of a laboratory cage. Larvae started to hatch about 8 : 00 AM C. W. T. on July 14 and continued hatching for several hours. Three larvae were allowed to penetrate the human skin. Complete entry of one larva took 18 minutes and the other larvae were two-thirds in when removed at 18 and 25 minutes from the time of first attachment. Larvae placed on two guinea pigs, four white rats, one white-footed mouse, and four pack rats, failed to mature warbles. Twenty-two larvae were placed on a half-grown, white rabbit, four of which were inserted into the nostrils. The rabbit died July 20 and a single second instar larva was found under each foreleg in connective tissue between the skin and underlying muscle tissue. One had made an opening in the skin to the exterior. Eight larvae placed on two similar rabbits matured three and one larvae by August 13, although the existence of four and five had been noted previously. Apparently three of the mature warbles were eaten by the rabbits; the fourth pupated August 14. Very rapid healing of the empty warble holes was noted.

50. *On the Structure of the So-Called "Stigmata" of Larval Ticks.* Harold Elishewitz, University of Minnesota.

Despite assertions by morphologists that larval ticks lack a tracheal system, tick taxonomists have, almost without exception, continued to refer to a series of four pairs of placodes in the body wall as "stigmata." These placodes, appearing in surface view like a pair of mitral valves surrounded by a sclerotized peritreme, are located posterior to the subcoxae of the three pairs of legs on the ventral surface and anterior to the last festoons on the dorsolateral surface. The distribution of these plaques shows generic and specific variation.

It is here shown that each of these "stigmata" is in reality the orifice of a complex sensory-glandular system to which the term sensillum glandularis is applied. The system, in *Dermacentor variabilis,* consists of an elliptical, cone-shaped sclerotized annulus surrounding a bullet-shaped, thin-walled, hollow sensory cone. The apical quarter of the cone is invested by a chitinous apical membrane that arises from a small membranophore ridge which rings the inner wall of the annulus. The base of the cone sits upon an elliptical sensillar ring into whose hollow center a solid sclerotized sensory peg is inserted. Two closely apposed, relatively enormous hypodermal gland cells pour their secretion into the space between the cone and the annulus. Located between the gland cells is a prominent neurone whose efferent fibers terminate at the base of the sensillar ring and sensory peg. The glands function during molting while the sensory function is probably olfactory.

51. *The Taxonomy of the Pathogenic Rickettsiae.* Cornelius B. Philip, Army Medical School.

In reviewing the purely systematic aspects of the human pathogenic rickettsiae, it is pointed out that considerable confusion has arisen from disregard of accepted taxonomic procedure in proposal of many new specific names. Adequate taxonomic stability will have to await further "biological" clarification of the interrelationships of the aetiologic agents now arbitrarily placed in the group. Many synonyms are apparent even now, however, among specific names. Excluding certain problematic forms in this discussion, the accepted species may be grouped under 3 subgenera of the genus *Rickettsia,* namely, *Rickettsia* s. str. which includes the type species *prowazeki* (with 1 synonym) of epidemic typhus, subspecies *typhi* (4 synonyms including *mooseri*) of endemic typhus, and *orientalis* of tsutsugamushi fever (8 synonyms); *Dermacentroxenus* which includes *rickettsi* (2 synonyms) of Rocky Mountain spotted fever and subspecies *conori* (2 synonyms) of boutonneuse fever and South African tick bite fever; and a new subgenus for the Q fever group with one species, *burneti* (1 synonym).

52. *Age as a Factor in the Resistance of Splenectomized Rats to Infection with* Bartonella muris. Walter R. Kessler, Columbia University and College of the City of New York.

Splenectomized rats of six different age groups (ranging from 12 to 150 days) were inoculated with various concentrations of *Bartonella muris*-infected erythrocytes. Inocula which induce fatal infection in almost 100 per cent of the older animals tested (27, 40, 60, 80, and 150 days of age) produce no fatalities among rats of suckling age (12 days at the time of inoculation). Not only the eventual outcome of the infection but the development, course, and symptomatology of the disease in animals of suckling age differs from that shown by other age groups. Although the patent period was found to be fairly constant for all animals, being on the average about 3 days, the prepatent period was longest for rats of suckling age. Invariably, in rats of the older age groups, a marked loss in body weight is observed during the terminal phase of the infection and hemoglobinuria is common. In none of the members of the 12-day-old group were either weight loss or hemoglobinuria noted. In older animals as many as 80 or 85 per cent of the red cells may be invaded by numerous (40 to 50) parasites. On the other hand, in rats of suckling age, both the number of infected cells as well as the number of organisms per cell is considerably less; indeed, only in rare instances are as many as 50 per cent of the erythrocytes invaded.

The general level of red cell production as indicated by the presence of immature erythrocytes, particularly normoblasts, was more vigorous in the rats of suckling age than in older animals. Normoblasts appear to be completely resistant to invasion by *Bartonella muris;* immature red cells likewise tend to be less frequently and more sparsely infected. This fact is no doubt directly related to the relative resistance of splenectomized rats of suckling age to infection with *Bartonella muris.*

53. *The Pathogenicity of Three Strains of* Trichinella spiralis *as Indicated by Lethal Dose and Survival Time.* Irving Rappaport, Cornell University.

Although some workers believe that a variation in virulence may exist among strains of *Trichinella,* no evidence for it has been reported. In the present study of the problem, larvae of three different strains were obtained by peptic digestion, counted directly in graded doses, and administered to mice by stomach tube. Results obtained with the three strains were quite similar in regard to lethal dose and survival time. By combining the results obtained with all three strains, these criteria of lethal dose and survival time can be more accurately evaluated.

All animals receiving overwhelming doses (over 140 larvae per gram of body weight) died between 2 and 4 days after infection. The survival time up to 60 days was quite variable when doses between 60 and 100 larvae per gram were given, making it almost impossible to predict the survival time. The percentage of animals which survived was dependent upon dosage. All mice receiving more than 80 larvae

per gram died during the 60-day interval. The percentages of animals that survived doses from 10 to 85 larvae per gram of body weight at 10 larvae per gram intervals were: 100, 100, 64, 65, 44, 30, 5, and 5, respectively. There appeared to be little or no difference among the three strains of *Trichinella* studied. It is believed, however, that the criteria of lethal dose and survival time possess many limitations and that other methods, such as longevity and sex-ratio studies of the adult parasites, are far superior for such investigations in experimental trichiniasis.

54. *Tests for a Hemolytic Substance in* Chabertia ovina. W. L. Threlkeld, Virginia Agricultural Experiment Station.

Ten thousand infective larvae of *Chabertia ovina* were administered to a three-month-old lamb. The animal was killed two months later, and 426 mature *Chabertia* were recovered. Two hundred and fifty worms, fixed in 70 per cent alcohol, were utilized as described. The anterior portion of the worms (esophagus and head) was severed. The anterior and posterior portions were washed repeatedly in Ringer's solution, then in 0.87 per cent saline, transferred to 95 per cent alcohol, triturated, and filtered through a Berkefeld N filter. After evaporation and drying, the product from the filtrate and the unfiltered residue were taken up in sterile 0.87 per cent saline and added to a solution of fresh defibrinated sheep blood, made by adding 19 cc of sterile 0.87 per cent saline to 1 cc of blood. After 18 hours of incubation at 37.5° C, hemolysis occurred. Similar results were obtained after 22 hours' incubation at 37.5° C from the product of 56 whole worms which were taken from a nine months' old lamb which had retained the infection for five months. A further study is planned to determine more conclusively whether a hemolytic substance is present in *Chabertia ovina*.

55. *Factors Influencing the Oxygen Consumption of a Larval* Eustrongylides. Theodor von Brand, Catholic University of America.

The oxygen consumption of a larval *Eustrongylides* from *Fundulus* remained constant in the pH range of 3.4 to 8.3, but was increased in the pH ranges 1.1 to 2 and 9 to 10.7. The significance of the increased respiration in the latter case remains unclear. The stimulation in the extreme acid range, however, may have a biological foundation, since the worm bores into the stomach wall of the definitive host. The temperature relationships were investigated in the range of 5 to 48° C. The increase in respiration with increasing temperature could be expressed with two lines only if the Q_{10} was calculated or if Arrhenius' formula was used. The influence of various ions in isotonic solutions upon the oxygen consumption was also studied. The least stimulating cations and anions respectively were Na and Cl. The maximally stimulating ones were K and PO_4.

56. *Survival on Soil of Oöcysts of Two Species of Swine Coccidia,* Eimeria debliecki *and* E. scabra. John Lawrence Avery, United States Bureau of Animal Industry.

During the interval from May, 1941, to July, 1942, the survival periods on soil of oöcysts of *Eimeria debliecki* and *E. scabra* were investigated at Beltsville, Maryland. It was considered that the information obtained would be useful in formulating control measures against these parasites. Two test plots, each 15 feet square, were fenced off in a pasture which for several months previously had been occupied by swine infected with the species of coccidia named. The infected hogs were removed from the area prior to the beginning of the experiment. One plot was constantly shaded by trees, the other was unshaded and both were kept free of vegetation. At intervals of 4 to 8 weeks the viability of the oöcysts was tested by maintaining on each plot for a period of 3 days a pig that had been raised free of coccidia. The pigs were then removed to separate cement-floored pens and the feces collected daily; the numbers of oöcysts present were estimated by the dilution technique. The investigation showed that the oöcysts on both plots were still viable after 15

months. However, infections acquired from the unshaded plot were lighter than those acquired from the shaded area. Temperatures of the surface soil of the two plots ranged from + 40° C to – 4.5° C. These findings show that under the temperature conditions named allowing an infested hog lot to remain vacant as long as 15 months may not preclude infections of susceptible pigs with the two species of coccidia named and indicate that longer periods of rotation may be essential to effective control.

57. *The Effect of Moderately Low Temperatures on the Sporulation of Oöcysts of Two Species of Swine Coccidia.* JOHN LAWRENCE AVERY, United States Bureau of Animal Industry.

Unsporulated oöcysts of *Eimeria debliecki* and *E. scabra* cultured in tap water were exposed to (1) a temperature slightly above freezing (6 to 8° C), (2) alternate freezing and thawing (0.5 to – 3° C), and (3) continuous freezing (– 2 to – 7° C) to ascertain the effect on sporulation; two cultures were maintained at each temperature; two other cultures kept at room temperature (19 to 25° C) served as controls. Each culture consisted of approximately equal numbers of oöcysts of each of the two species in question in 25 cc of tap water contained in a petri dish 3 inches in diameter; the oöcysts were obtained by the sugar-flotation technique from the feces of a pig harboring a natural infection of the species named. After the cultures had been exposed to the various temperatures in question for a period of 26 days, 100 oöcysts from the two cultures kept at each temperature were examined and the percentage of sporulation ascertained. At that time 93 per cent of the oöcysts in the control cultures had sporulated but no sporulation was observed in any of the cultures exposed to lower temperatures. The cultures were then maintained at room temperature (19 to 26° C) for a period of 14 days and were then examined. The percentages of sporulation in the three groups of cultures at that time were 88 per cent, 67 per cent, and 55 per cent, respectively; no change was noted in the percentage of sporulated oöcysts in the control cultures. In the case of individual cultures approximately equal numbers of oöcysts of the two species sporulated.

58. *The Segmental Anatomy of* Mesocestoides variabilis *Mueller, 1928, from* Didelphis virginiana *Kerr.* ELON E. BYRD, University of Georgia, AND JAMES W. WARD, Mississippi State College.

From a study of the immature, mature and gravid segments of a series of specimens taken from *Didelphis virginiana* in Mississippi the writers have been able to definitely identify the tapeworm parasite as *Mesocestoides variabilis* Mueller, 1928. Since no scoleces were recovered from the host, only segments have been examined. These reveal certain features of the anatomy of this cestode which heretofore have remained obscure, or have not been made clear in the published accounts of the species described as belonging to the genus. The arrangement of the muscle fibers, the excretory ducts, the general arrangement of the reproductive organs, and the manner in which the egg capsule (paruterine organ) is formed are some of the features.

59. *Notes on the Genital System of the Bird Fluke,* Apharyngostrigea cornu (*Zeder*). ELON E. BYRD, University of Georgia, AND JAMES W. WARD, Mississippi State College.

The general anatomy of the bird fluke, *Apharyngostrigea cornu* (Zeder), from the little blue heron, *Florida caerulea caerulea,* from Mississippi, is discussed. From a study of serial sections of the parasite the course and the connections made by the various genital ducts have been worked out in detail.

60. *The Parasites of the Caecilidae* (*Amphibia: Apoda*). A. C. WALTON, Knox College.

Annotated records are presented from six species of hosts (*Dermophis mexi-*

canus, Scolecomorphus uluguruensis, S. unicolor, S. vittatus, Siphonops annulatus, and *Uraeotyphlus oxyurus*) of the presence of six species of Nematoda (*Ascaris unguiculata, Oxysomatium mexicanum, Raillietnema loveridgei, R. multipapillata, Rhabdias bdellophis,* and *R. escheri*); and from two species of hosts (*Dermophis mexicanus,* and *Uraeotyphlus oxyurus*) of the presence of Trematoda (*Cercorchis patonianus* and *Gorgoderina carli*). Other types of parasites apparently have not been recorded. Brazil, East Africa, India, and Mexico cover the geographical area represented by the various hosts.

61. *The Parasites of the Cryptobranchoidea (Amphibia: Caudata).* A. C. WALTON, Knox College.

Records of parasitic infection of members of the Cryptobranchoidea are as follows:

I. Hynobiidae: a. *Hynobius fuscus, hida, kimurae, stejnegeri* and *tokyoensis* are infected by *Aplectana* (1), *Rhabdias* (1), *Pharyngodon* (2) and *Capillaria* (1), species of Nematoda; *Hynobius fuscus, stejnegeri* and *tokyoensis* by *Gorgoderina* (1) and *Mesocoelium* (2), species of Trematoda; and *Hynobius tokyoensis* by the protozoon *Trichodina okajimae.* b. *Onychodactylus (japonicus)* is infected by *Capillaria* (1), *Pharyngodon* (2), and *Rhabdias* (1), species of Nematoda; and by unidentified flagellates.

II. Cryptobranchidae: a. *Cryptobranchus (alleganiensis)* is infected by *Filaria* (1), *Spironoura* (2), *Spiroxys* (1), and *Zanclophorus* (1), species of Nematoda; by *Cercorchis cryptobranchi* (Trematoda); by *Ophiotaenia cryptobranchi* (Cestoda); and by *Proteromonas* (1), *Trichomonas* (1), and by *Trypanosoma* (1), species of Protozoa. b. *Megalobatrachus (japonicus)* is infected by *Filaria cingula* (Nematoda); by *Diplodiscus* (1), *Liolope* (1), *Opisthodiscus* (1), and larval *Phyllodistomum* (1), species of Trematoda; by *Bothriocephalus* (Cestoda); and by unidentified flagellates.

62. *The Parasites of the Ambystomoidea (Amphibia: Caudata).* A. C. WALTON, Knox College.

Annotated records of the various parasites listed as attacking members of the Ambystomoidea are presented as follows: Ambystomidae: a. *Ambystoma (opacum, talpoideum, texanum, tigrinum,* and *A.* sp?) by *Capillaria* (1), *Cosmocercoides* (1), *Filaria* (1), *Gordius* (1), *Hedruris* (1), *Spironoura* (2), and *Spiroptera* (1), species of Nematoda; *Ambystoma (jeffersonianum, maculatum, opacum, punctatum, texanum, tigrinum,* and larval ambystomids) by *Brachycoelium* (1), *Cercaria* (1), *Diplostomulum* (1), *Gorgodera* (1), *Gorgoderina* (1), *Megalodiscus* (1), *Opisthioglyphe* (1), and *Phyllodistomum* (1), species of Trematoda; *Ambystoma (opacum,* and *tigrinum*) by *Diphyllobothrium* (1), *Ligula* (1), and *Ophiotaenia* (1) species, and proteocephalid cysts—Cestoda; *Ambystoma opacum* by *Acanthocephalus acutulus* (Acanthocephala); *Ambystoma (jeffersonianum, maculatum, opacum, texanum, tigrinum,* and unidentified ambystomids) by *Balantidium* (1), *Chilomastix* (1), *Cryptobia* (1), *Cytamoeba* (1), *Eimeria* (1), *Euglenamorpha* (1), *Eutrichomastix* (1), *Glaucoma* (1), *Haptophrya* (1), *Hexamastix* (1), *Hexamita* (1), *Karotomorpha* (3), *Proteromonas* (1), *Protoopalina* (1), and *Trichomonas* (1), species of Protozoa; and *Ambystoma (maculatum* and *opacum*) by *Hannemania dunni* (Acarina). b. *Dicampton ensatus* larvae by *Phyllodistomum singulare* (Trematoda). Host material came from Canada, Mexico, and the United States.

63. *The possibility of Chemical Control of the Snail Intermediate Hosts of* Schistosoma mansoni *in Venezuela. II.* GEORGE W. LUTTERMOSER, Instituto Nacional de Higiene, Caracas, Venezuela.

In the laboratory, it was found that a 1:1,000 solution of recently slaked lime (about 50 per cent pure) not only killed the snail intermediate hosts of *Schistosoma*

mansoni but also killed the eggs of the same snails. These eggs failed to develop after remaining in said solution for 6 to 24 hours. A study of the effect of each of the principal components of the lime solution on the snails indicated that most likely the hydroxide present was the factor lethal for the snails. The cercariae of *S. mansoni* died within 15 to 30 minutes in the 1 : 1,000 lime solution.

This year the following snail-infested zones in populated areas about Caracas were successfully treated with lime: 1500 feet of an irrigation canal with an intermittent flow of water; a 300-foot section of an irrigation canal with continuously running water; a large reservoir; and a section of a river 1500 feet long and 6 to 12 feet wide. Examination of snails collected before and after the first application of the lime indicated that more than 90 per cent of the numerous snails found alive were killed by the treatment. By means of applications of lime every two or three months, it was possible to maintain the first three zones practically free of snails for a test period of six months and at a low expenditure. From the collections made, it was estimated that some 150,000 potential snail carriers of *S. mansoni* were killed in the river and 14 per cent of the collections were found harboring the cercariae of *S. mansoni.*

64. *A Peculiar Larval Development of* Rhabdochona *spp.* (*Nematoda: Spiruroidea*). Paul V. Gustafson, Whitworth College.

The larval development of several species of *Rhabdochona* occurs in various mayfly nymphs. Generic characteristics are established by the end of the second stage, which is followed immediately by encystment. Growth and maturation do not cease but may continue through at least one more molt. In one experiment, a *Hexagenia* nymph seven months after infection contained three excysted males, all of which were apparently mature although they were still partly encased in a shed cuticle. The pattern of the papillae, spicules, head structures, and total body size all agreed with the adult description. Natural infections of *Rhabdochona cascadilla* in *Hexagenia* could be identified from the precocious larvae. In several females, unfertilized ova could be seen within the uterus, while many males exhibited mature spicules, papillae pattern, and sperms within the reproductive system. Such precocious development has not been previously reported for this group.

65. *African Sleeping Sickness.* Eugene R. Kellersberger, American Mission to Lepers, New York.

No abstract received.

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